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A PLEA FOR A BROADER BOTANY.

BY L. H. BAILEY.

THE science of botany, as ordinarily considered and taught, has not laid hold of the full amount of territory to which it is entitled, and it has not, therefore, reached its full measure of usefulness. Strictly speaking, botany is the science of plants, but by general consent it appears to have dwarfed itself into a science of wild plants; or if it deals with cultivated plants they are such as fall to the care of botanical gardens, or, in other words, those which are cultivated for the sole purpose of maintaining a collection. It is not strange that in the earlier days botanists should have eliminated from their domain the whole realm of cultivated plants, for cultivation then meant little else than the maintenance and improvement of plants for merely economic purposes, and there was little science of cultivation. But now that the teachings of evolution have thrown a new purpose into the study of all natural objects, cultivated plants have acquired a fascinating interest from the abundant light which they throw upon variation and descent. In fact, aside from paleontology, there is no direction in which such abundant material can be found for the study of evolution as in cultivated plants, for in nearly all of them the variation is fully as great as in domesticated animals, while the species are very many times more numerous; and, by the fostering aid rendered by man, the accumulative effects of modified environment and selection are much more quickly seen — and therefore more intelligible — than in wild plants. My nearest neighbor, who is a paleontologist, and myself, a horticulturist, compare our respective fields of study to the decay and burning of a log. In both decay and burning the same amount of work is finally accomplished and the same amount of heat is evolved, but one process requires years, perhaps a century, for its accomplishment, and the other requires but a few hours. Cultivated plants afford within definite periods of time as much variation and progression as their wild prototypes exhibit in ages. So the garden is one of the best places in which to study evolution. It is a com-

mon opinion, to be sure, that the variation of cultivated plants is anomalous and uninteresting because influenced by man, but this is wholly erroneous. I have yet to find a variation in cultivated plants which can not be explained by laws already announced and well known. It is strange that one can ever believe that any variation of natural objects is unnatural!

But wholly aside from the fascinations of pure science, cultivated plants and cultivation itself demand the attention of the botanists, for horticulture is nothing more than an application of the principles of botany. Just now, mycology is making important additions to horticultural practice, but there are greater fields for the applications of an exact science of plant physiology, whenever that science shall have reached a proportionate development. In short, the possibilities in horticulture, both in science and practice, are just as great as they are in the science of botany upon which it rests; and inasmuch as it is absolutely impossible to separate horticulture and botany by any definition or any practical test, the two should go together in an ideal presentation of the science of plants. Horticulture belongs to botany rather than to agriculture.

The ideal chair or department of botany, therefore, should comprise, in material equipment, laboratories, botanic garden, green-houses, orchards, vegetable and ornamental gardens, all of which should be maintained for purposes of active investigation rather than as mere collections; and I am sure that no department of botany can accomplish the results of which the science is capable until such breadth of equipment is secured. I am aware that there are difficulties in such a comprehensive field, but the only serious one is the lack of men. Botanists, as a rule, care little for gardens and cultivated plants, and horticulturists are too apt to undervalue the importance of scientific training and investigation; but the time cannot be far distant when men shall appear with sufficient scientific and practical training to appreciate the needs of the whole science and with enough executive ability to manage its many interests. Such men are no doubt teaching in some of our colleges to-day, were the opportunity open to them. One cannot be a specialist in all or even several of the many subjects comprised in this ideal, but he may possess the genius to encourage and direct the work of other specialists. The first need is the opportunity, for there is not yet, so far as I know, an ideal chair of botany in existence, where the science can be actively studied in its fullest possibilities and then be presented to the student and the world.

Cornell University.

THE LAWS AND NATURE OF COHESION.

BY REGINALD A. FESSENDEN.

DESIROUS of finding some relation between the conductivity of metals and their other physical properties, the writer, several years ago, began to tabulate all the data he could find. Realizing the uselessness of comparing the properties of substances whose natures are essentially different, as wood and iron, it was decided to confine the work to the elementary substances. It was found that the only elements whose properties were at all well known were those of the five chemical groups comprising the following metals: I., iron, nickel, cobalt, platinum, osmium, iridium; II., sodium, copper, silver, gold; III., magnesium, zinc, cadmium, mercury; IV., aluminium, thallium, indium, gallium; V., silicon, tin, lead.

The data collected were not very concordant, but when they had been compared and the most probable values taken, laying due stress on the purity of the substances examined and the standing